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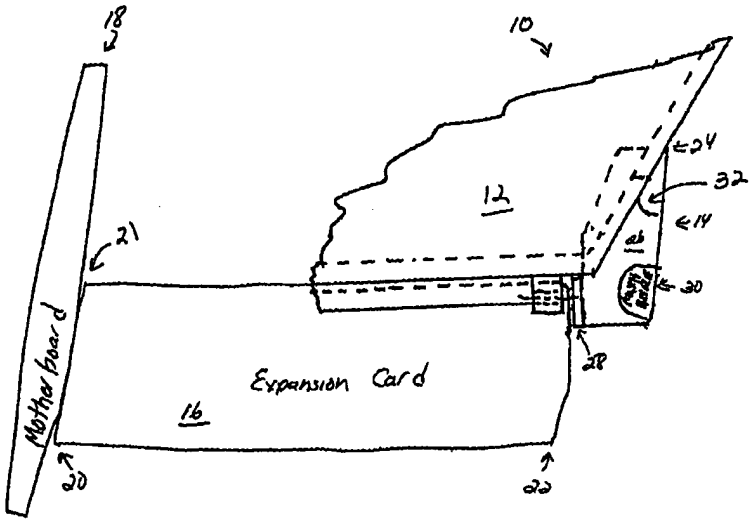

(57) Abstract

An apparatus for maintaining the position of an expansion card includes a latch (14) that secures the connection between the expansion card (16) and its parent card (18). To that end, the apparatus includes a base (12), and the latch (14) pivotably coupled to the base. The latch has a contact surface that defines a securing region between it and a top face of the parent card (18). The latch operates in either one of a securing region mode and a non-securing region mode. When in the securing region mode, the top end of the expansion card is maintained within the securing region. When in the non-securing region mode, the top end of the expansion card is permitted to be outside of the securing region.

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EXPANSION CARD SECURING APPARATUS

FIELD OF THE INVENTION

This invention generally relates to computer cards and, more particularly, this invention relates to securing the connection between coupled computer cards.

BACKGROUND OF THE INVENTION

Computers typically have a motherboard card ("motherboard") and one or more daughter board cards ("daughter boards" or "expansion cards") that are coupled to the motherboard. Exemplary daughter boards typically utilized within conventional computer systems include random access memory cards, graphics acceleration cards, and other auxiliary processor cards. To facilitate a mechanical connection to a motherboard, each daughter board typically has an edge connector that mates with a matching interface on the motherboard. This connection permits the two cards to electronically communicate so that they may operate as a single unit.

During shipping or normal use, edge connectors can disconnect from the motherboard interface. This mechanical disconnection causes the two cards to lose electrical communication, thus electrically removing the daughter board from the computer system. As a consequence, at least part of the computer system can malfunction.

The art has responded to this problem by providing mechanical fasteners (*e.g.*, screws) that secure the motherboard/daughter board connection. Use of such fasteners, however, can cause damage to the motherboard when replacing or adding daughter boards to a computer system. For example, use of a metal screwdriver to remove screws can undesirably cause a static electricity discharge that damages the motherboard. Moreover, use of any tools to replace a daughter board is cumbersome.

SUMMARY OF THE INVENTION

In accordance with one aspect of the invention, an apparatus for maintaining the position of an expansion card includes a latch that secures the connection between the expansion card and its parent card. To that end, the apparatus includes a base, and the latch pivotably coupled to the base. The latch has a contact surface that defines a securing region between it and a top face of the parent card. The latch operates in either one of a securing region mode and a non-securing region mode. When in the securing region mode, the top end of the expansion card is maintained within the securing region. When in the non-securing region mode, the top end of the expansion card is permitted to be outside of the securing region.

In preferred embodiments, the contact surface on the latch is substantially parallel to the top face of the parent card. The base may have a bottom face that is substantially orthogonal to the expansion card. In some embodiments, the latch defines an angle with the base. The angle is greater when the latch is in the non-securing region mode than when it is in the
securing region mode.

The latch may include a leaf spring that is normally biased into the securing mode. The base may form a groove that receives a side of the expansion card. The contact surface may contact the top end of the expansion card when in the securing region mode. In alternative
embodiments, the apparatus includes the parent card and the expansion card.

In accordance with another aspect of the invention, an apparatus for maintaining the position of an expansion card includes a base with a bottom surface, and a latch movably coupled to the base. The latch preferably has a contact surface that, with a parent card, defines an expansion card securing region for securing the expansion card. The latch is movable between a securing region mode and a non-securing region mode. When in the securing region mode, the latch maintains the entire expansion card within the securing region. In contrast, when in the non-securing region mode, the latch permits at least a part of the expansion card to be outside of the securing region.

In preferred embodiments, the latch is pivotably coupled to the base. The base may form a groove that receives a side of the expansion card. In other embodiments, the apparatus includes the expansion card and the parent card.

In accordance with another aspect of the invention, a computer assembly includes a parent card, an expansion card normally coupled to the parent card, a base, and a latch coupled to the base to secure the expansion card. The latch includes a contact surface that, with the base and parent card, define a securing region. The latch is movable between a securing region
mode and a non-securing region mode. When in the securing region mode, the latch maintains the entire expansion card within the securing region. In contrast, when in the non-securing region mode, the latch permits at least a part of the expansion card to be outside of the securing region.

In preferred embodiments, the latch is pivotably coupled to the base. In other embodiments, the latch permits the top end of the expansion card to be outside of the securing region when in the non-securing mode.

BRIEF DESCRIPTION OF THE DRAWINGS

The foregoing and other objects and advantages of the invention will be appreciated more fully from the following further description thereof with reference to the accompanying drawings wherein:

Figure 1 shows an isometric view of a preferred expansion card securing assembly.

Figure 2 shows a perspective view of the expansion card assembly shown in figure 1.

Figure 3 schematically shows a bottom view of the assembly shown in figure 1.

DESCRIPTION OF PREFERRED EMBODIMENTS

In accordance with a preferred embodiment of the invention, a card securing assembly secures an expansion card to a top face of a motherboard. To that end, the assembly includes a latch that both secures the expansion card to the motherboard, and

permits the expansion card to be easily removed. The assembly preferably is utilized within a computer chassis of a computer system. The computer system may be any conventionally known computer system, such as the Intergraph EXTREME-Z™ graphics workstation, distributed by Intergraph Corporation of Huntsville, Alabama.

Figures 1 and 2 show a preferred embodiment of the card securing assembly ("assembly 10"). The assembly 10 includes a base portion ("base 12"), and a latch 14 pivotably coupled to the base 12 to secure an expansion card 16 to a motherboard 18. Although not necessary, the base 12 preferably is substantially orthogonal to the expansion card 16. The expansion card 16 includes a bottom end 20 that is coupled to an expansion card interface 21 on the motherboard 18, and a top end that normally contacts the latch 14. The latch 14 preferably is in the form of a leaf spring that is normally biased to retain the expansion card 16 in the interface 21 on the motherboard 18. The expansion card 16 may be any type of expansion card, such as a graphics accelerator or random access memory.

The latch 14 includes a connection point 24 that is connected to the base 12, and a spring arm 26 that terminates at a contact surface 28. The contact surface 28 normally contacts the top end of the expansion card 16, thus securing the bottom end 20 of the card in the interface 21 on the motherboard 18. In preferred embodiments, the contact surface 28 is a flat, rectangular surface that is substantially parallel to the top face of the motherboard 18.

The region between the contact surface 28 and the inside face of the motherboard 18 (*i.e.*, the face of the motherboard 18 that couples the card 16) therefore is considered to be a securing region for the card 16. The latch 14 thus acts to either permit the card 16 to, or prevent the card 16 from, move outside of this securing region. Details of this interaction are discussed below.

Application of a generally downwardly directed force (*i.e.*, a force generally in the direction opposite the base 12) to the top surface of the latch 14 causes the latch 14 to pivot downwardly (relative to the base 12) at the connection point 24. The force may be applied manually, such as by a person's finger. In some embodiments, the latch 14 has a depression 30 for applying the force. The latch 14 preferably has a range of motion that

permits it to be pivoted so that, when fully extended, the contact surface 28 does not contact any part of the expansion card 16. In fact, when in this fully extended position (discussed above and referred to below as a "non-securing mode"), no part of the latch 14 can prevent the expansion card 16 from moving in a direction away from the motherboard 18. Removal of the downwardly directed force, however, causes the latch 14 to return to its normally biased position.

The latch 14 thus is considered to operate in either one of two modes. In particular, the latch 14 operates in a securing mode when it retains the expansion card 16 in its interface 21, and in a non-securing mode when it is pivoted downwardly to permit the card to move away from the motherboard 18. The spring arm 26 of the latch 14 forms an angle 32 with the base 12 that is larger when in the non-securing mode than when in the securing mode. As noted above, when in the securing mode, the contact surface 28 preferably directly contacts the top end of the card. In alternative embodiments, however, there may be a space between the contact surface 28 and the top end of the card. In either embodiment, the top end of the card cannot move away from the motherboard 18 beyond the contact surface 28.

In preferred embodiments, the assembly 10 is a single molded assembly that is manufactured in accord with conventional injection molding processes. General purpose grades of polycarbonate, engineering grade thermoplastic, or other material may be utilized to manufacture the assembly 10. For example, polystyrene may be used. In preferred embodiments, the bottom face of the base 12 is manufactured to have a groove 34 that receives a side of the card (see figure 3). Among other functions, the groove 34 further secures the card to the interface 21 on the motherboard 18. In alternative embodiments, the base 12 and latch 14 are separately formed parts that are coupled together, such as by a screw.

The assembly 10 may include a plurality of latches 14. In preferred embodiments, each groove 34 on the bottom face of the base 12 includes an accompanying latch 14. Accordingly, the assembly 10 may be utilized to secure a plurality of expansion cards 16 to one or more motherboards 18.

It should be noted that although the terms "motherboard" and "expansion card" have been discussed, principles of the invention may be applied to any coupling technology that couples two computer cards. Accordingly, those terms have been utilized herein as examples only.

Instead of utilizing a leaf spring, the latch 14 may include a hinge or similar mechanism (not shown) that locks the latch 14 in the securing mode, and easily permits it to be moved to the non-securing mode without resort to tools. Any mechanism or apparatus known the art may be utilized to effectuate this function. As an additional example, the latch 14 may have a hook (not shown) that secures it into position. Accordingly, as previously noted, use of a leaf spring is a preferred embodiment and not intended to limit the scope of the invention.

The assembly 10 is secured within a computer chassis by any conventional means. For example, it may be secured to the motherboard 18, or an interior surface of the computer chassis. In some embodiments, the assembly 10 is secured to a cooling fan. The assembly 10 thus defines air channels that easily permits air to flow to the motherboard 18 and expansion card 16. See, for example, U.S. Patent number 5,822,188 and U.S. Patent number 5,892,654, the disclosures of which are incorporated herein, in their entireties, by reference for exemplary chassis interiors that facilitate airflow. The interior cards thus may be configured to facilitate air flow in a manner similar to that disclosed in those patents.

During anticipated normal use, the assembly 10 should secure the expansion card 16 to the motherboard 18. In particular, the latch 14 should prevent the card 16 from sliding along the groove 34 in the base 12, thereby limiting the freedom of movement of the card 16 outside of the latch 14. In addition, the latch 14 permits the expansion card 16 to be easily removed and/or replaced. Even when no card is coupled to the motherboard 18, one may be easily added merely by applying a generally downward force to the depression 30 on the latch 14, and inserting the card into the appropriate interface on the motherboard 18 (along the appropriate groove 34) when the latch 14 is fully extended.

Although various exemplary embodiments of the invention have been disclosed, it should be apparent to those skilled in the art that various changes and modifications can be

made which will achieve some of the advantages of the invention without departing from the true scope of the
invention. These and other obvious modifications are intended to be covered by the appended claims.

I claim:

1. An apparatus for maintaining the position of an expansion card, the expansion card having a bottom end and a top end, the bottom end normally being coupled to a top face of a parent card, the apparatus comprising:

a base; and

a latch pivotably coupled to the base, the latch having a contact surface, the region between the contact surface of the latch and the top face of the parent card being defined as a securing region, the latch being in one of a securing region mode and a non-securing region mode, the securing region mode maintaining the top end of the expansion card within the securing region, the non-securing region mode permitting the top end of the expansion card to move outside of the securing region.

2. The apparatus as defined by claim 1 wherein the contact surface on the latch is substantially parallel to the top face of the parent card.

3. The apparatus as defined by claim 1 wherein the base has a bottom face that is substantially orthogonal to the expansion card.

4. The apparatus as defined by claim 1 wherein the latch defines an angle with the base, the angle being greater when the latch is in the non-securing region mode than when it is in the securing region mode.

5. The apparatus as defined by claim 1 wherein the latch includes a leaf spring that normally biases the latch into the securing region mode.

6. The apparatus as defined by claim 1 wherein the base forms a groove that receives a side of the expansion card.

7. The apparatus as defined by claim 1 wherein the contact surface contacts the top end of the expansion card when in the securing region mode.

8. The apparatus as defined by claim 1 wherein the apparatus further includes the parent card and the coupled expansion card.

9. An apparatus for maintaining the position of an expansion card having a bottom end and a top end, the bottom end normally being coupled to a top face of the parent card, the apparatus comprising:

a base having a bottom surface; and

a latch movably coupled to the base, the latch having a contact surface, the top face of the parent card and the contact surface defining an expansion card securing region for securing the expansion card, the latch being movable between a securing region mode and a non-securing region mode, when in the securing region mode, the latch maintaining the entire the
expansion card within the securing region, when in the non-securing region mode, the latch permitting at least a part of the expansion card to be outside of the securing region.

10. The apparatus as defined by claim 9 wherein the latch is pivotably coupled to the base.

11. The apparatus as defined by claim 9 wherein the base forms a groove that receives a side of the expansion card.

12. The apparatus as defined by claim 9 wherein the apparatus further includes the parent card and the coupled expansion card.

13. The apparatus as defined by claim 9 wherein the contact surface on the latch is substantially parallel to the top face of the parent card.

14. The apparatus as defined by claim 9 wherein the base has a bottom face that is substantially orthogonal to the expansion card.

15. The apparatus as defined by claim 9 wherein the latch defines an angle with the base, the angle being greater when the latch is in the non-securing region mode than when it is in the securing region mode.

16. The apparatus as defined by claim 9 wherein the latch includes a leaf spring that normally biases the latch into the securing region mode.

17. The apparatus as defined by claim 9 wherein the contact surface contacts the top end of the expansion card when in the securing region mode.

18. The apparatus as defined by claim 9 wherein when in the non-securing region mode, the latch permits the top end of the expansion card to be outside of the securing region.

19. An computer assembly comprising:

a parent card;

an expansion card normally coupled to the parent card;

a base; and

a latch coupled to the base, the latch having a contact surface, the region defined by the contact surface, base, and the parent card being a securing region, the latch being movable between a securing region mode and a non-securing region mode, the latch being in the securing region mode when the expansion card is entirely within the securing region, the latch being in the non-securing region mode when at least a part of the expansion card is not within the securing region.

20. The computer assembly as defined by claim 19 wherein the latch is pivotably coupled to the base.

21. The computer assembly as defined by claim 19 wherein when in the non-securing region mode, the latch permits the top end of the expansion card to move outside of the securing region.

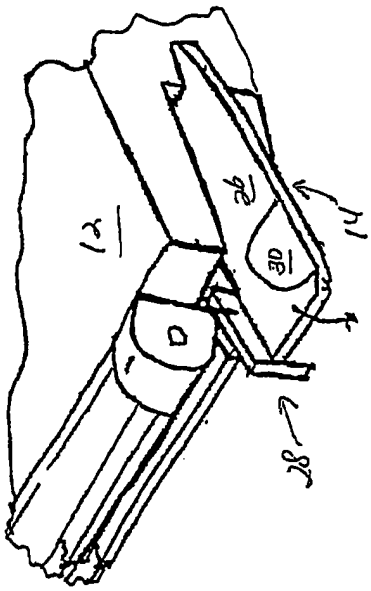
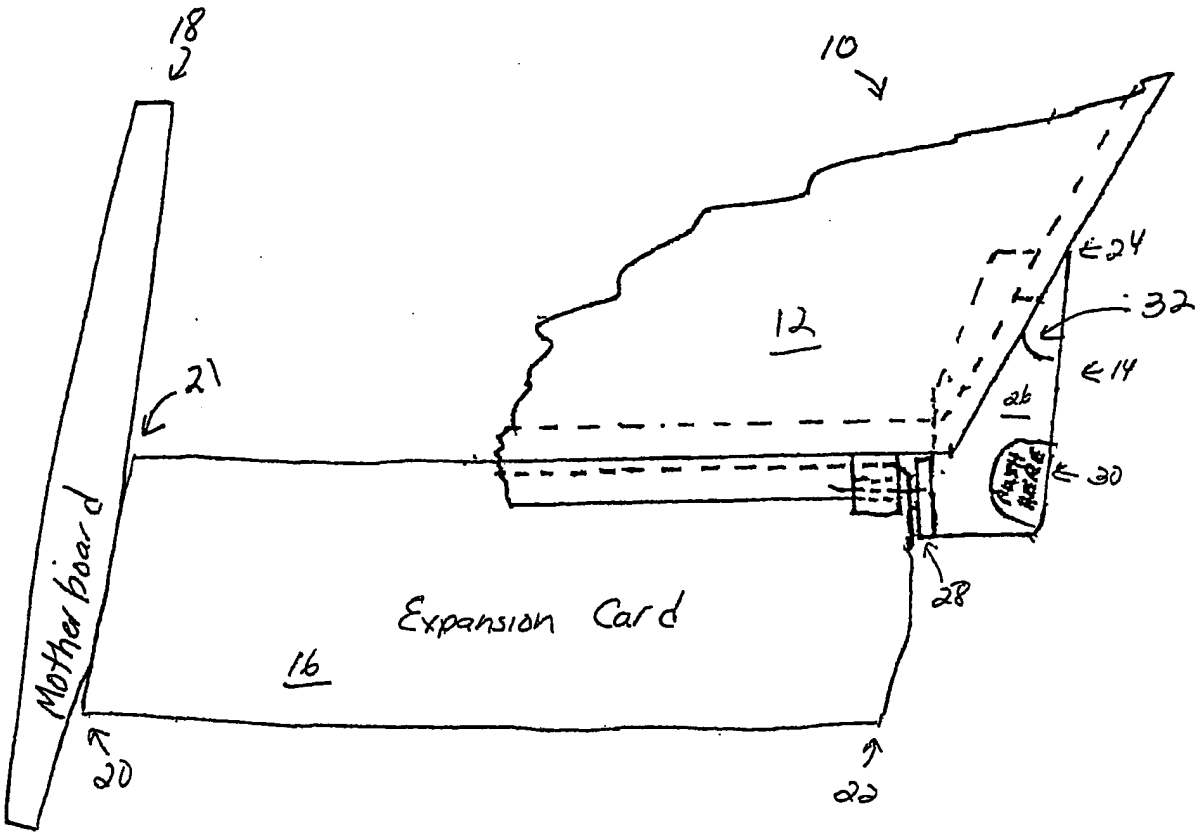


FIGURE 1


18
10
24
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14
21
26
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Mother board
Expansion Card
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16
20
22

FIGURE 2

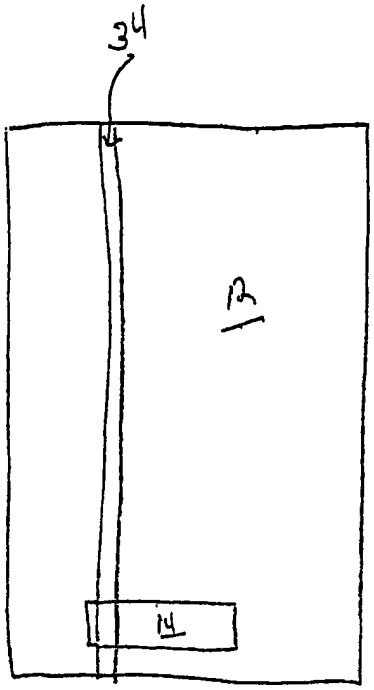

FIG 3

INTERNATIONAL SEARCH REPORT

Inte onal Application No
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A. CLASSIFICATION OF SUBJECT MATTER
IPC 7 H05K7/14

According to International Patent Classification (IPC) or to both national classification and IPC

B. FIELDS SEARCHED

Minimum documentation searched (classification system followed by classification symbols)
IPC 7 H05K

Documentation searched other than minimum documentation to the extent that such documents are included in the fields searched

Electronic data base consulted during the international search (name of data base and, where practical, search terms used)

C. DOCUMENTS CONSIDERED TO BE RELEVANT

Category °	Citation of document, with indication, where appropriate, of the relevant passages	Relevant to claim No.
X	US 5 680 296 A (HILEMAN VINCE ET AL) 21 October 1997 (1997-10-21) claims 1-12; figure 2	1,9,19
A	US 4 198 024 A (CAVANNA PETER J) 15 April 1980 (1980-04-15) column 3, line 47 -column 4, line 28; claims 1-5; figure 3	1

☐ Further documents are listed in the continuation of box C.

☒ Patent family members are listed in annex.

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Date of the actual completion of the international search	Date of mailing of the international search report
16 June 2000	30/06/2000

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INTERNATIONAL SEARCH REPORT

Information on patent family members

Inter ional Application No
PCT/US 00/04681

Patent document cited in search report	Publication date	Patent family member(s)	Publication date
US 5680296 A	21-10-1997	NONE	
US 4198024 A	15-04-1980	NONE	